

IN THE U.S. PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF APPEALS AND INTERFERENCES

Inventor	Robert E. LO et al	
Patent App.	10/511,865	
Filed	10 March 2005	Conf. No. 6670
For	METHOD FOR PRODUCING CRYOGENIC, SOLID MONOPROPELLANTS AND SOLID PROPELLANTS . . .	
Art Unit	1793	Examiner Mcdonough, J
Hon. Commissioner of Patents		
Box 1450		
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APPEAL BRIEF UNDER 37 CFR 41.37

Now come Appellants by their duly authorized attorney and submit their appeal brief under the provisions of 37 CFR 41.37.

(i) REAL PARTY IN INTEREST

The real parties in interest are the Appellants Roger E. Lo and Harry Adirim.

(ii) RELATED APPEALS AND INTERFERENCES

There are no prior or pending appeals, interferences or judicial proceedings known to Appellants or to Appellants' legal representative, which may be related to, directly affect, or be

directly affected by or have a bearing on the Board's decision in the pending appeal.

(iii) STATUS OF CLAIMS

Claims 1 through 16, 20, 21, 35, and 36 have been canceled.

Claims 17, 18, 19, 22 through 34, and 37 through 42 have been rejected and Appellants appeal the rejection of those claims.

(iv) STATUS OF AMENDMENTS

Appellants filed a Response Under 37 CFR 1.116 after Final Rejection on 23 December 2008, in which Appellants made no changes in the claims, and in which Appellants made of record no additional evidence of patentability. Appellants reargued that all of the claims in the pending application were free of the prior art and should not be rejected in view of the combinations of prior art references as obvious under 35 USC 103. Appellants received an Advisory Action mailed by the Examiner on 15 January 2009 indicating that the Examiner had considered the Response After Final Rejection, but that the response did not place the application in condition for allowance. Even though the Appellant made no changes in the claims and submitted no additional evidence in support of the arguments for patentability, the Examiner would

not enter the response After Final Rejection because it raised new issues requiring further consideration and/or search.

(v) SUMMARY OF CLAIMED SUBJECT MATTER

A first feature of the invention is a method of making a cryogenic solid monergole propellant out of a heterogeneous liquid-solid propellant, from reactants at least one of which is a fuel and an oxidizer which contains a phase that is liquid or gaseous at standard temperature, which comprises the steps of:

(a) incorporating at least one liquid or gaseous phase reactant in the form of an oxidizer in a solid phase structure, open pore plastic foam fuel, having hollow spaces which are connected to each other; and

(b) transforming the liquid or gaseous phase oxidizer incorporated in the solid phase structure, open pore plastic foam fuel, having hollow spaces connected to each other by freezing the liquid or gaseous phase into a stable cryogenic solid phase below standard temperature within the hollow spaces of the solid phase structure, open pore plastic foam fuel, inside a combustion chamber to obtain a rocket propellant with improved storability while avoiding the need for liquid management and simultaneously eliminating need for permanent ignition thereof.

This subject matter is claimed in independent claim 17, antecedent basis for which may be found in the specification on page 1, lines 4 through 11, on page 7, lines 19 through 21 in conjunction with original claim 1 in its entirety, and on page 9, lines 9 through 17, as well as in Figure 1.

A second feature of the invention is a stabilized cryogenic solid monergole propellant for a rocket motor combustion chamber equipped with an inner isolation which comprises a solid or heterogeneous quasi-monergolic fuel oxidizer combination cooled to below ambient temperature, wherein at least one reactant for preparing said propellant is an oxidizer in a liquid or gaseous phase at standard temperature, and at least one reactant for preparing said propellant is in a solid phase structure, open pore plastic foam fuel, having hollow spaces which are connected to each other, arranged at an inner isolation of the combustion chamber or completely filling the latter, the solid phase structure, open pore plastic foam fuel, having hollow spaces completely containing the liquid or gaseous oxidizer reactant cryogenically transformed and stabilized as a cryogenic solid.

This subject matter is claimed in independent claim 31, antecedent basis for which may be found in the specification on page 1, lines 4 through 11, on page 7, lines 19 through 21 in conjunction with original claim 10 in its entirety, and on page 9, lines 9 through 17, as well as in Figure 1.

A third feature of the invention is covered in dependent claim 18 and relates to a method of making a cryogenic solid monergole propellant wherein the at least one liquid or gaseous phase reactant as defined in independent claim 17 is an emulsion of liquid components which are not soluble in one another. Antecedent basis for this feature of the invention may be found in original claim 1, lines 5 through 8.

A fourth feature of the invention is covered in dependent claim 32 and relates to a stabilized cryogenic solid monergole propellant as defined in claim 31 wherein the at least one reactant for preparing said monergole propellant in a liquid or gaseous phase at standard temperature is an emulsion of liquid components not soluble in one another. Antecedent basis for this feature of the invention may be found in original claim 10, lines 3 through 6.

A fifth feature of the invention is covered in dependent claim 42 and relates to a stabilized cryogenic solid monergole propellant as defined in claim 31 wherein the solid phase structure, open pore plastic foam fuel, having hollow spaces is provided with a protective coating which chemically insulates the solid phase structure, open pore plastic foam fuel, from the reactant in the liquid or gaseous phase. Antecedent basis for this feature of the invention may be found in original claim 16.

(vi) GROUNDS FOR REJECTION TO BE REVIEWED ON APPEAL

The following issues are to be determined in this appeal:

1. Whether Claims 31, 33, 34, and 37 through 41, directed to a stabilized, cryogenic solid monergole propellant, should be rejected under 35 USC 103(a) as unpatentable over the combination of US Patent 3,259,532 to REYNOLDS, in view of US Patent 3,137,127 to GROSSE et al, and in further view of US Patent 5,529,648 to STICKLER.

2. Whether Claims 17, 19, 22 through 30, directed to a method of making a cryogenic solid monergole propellant, should be rejected under 35 USC 103(a) as unpatentable over the combination of US Patent 3,259,532 to REYNOLDS, in view of US Patent 3,137,127 to GROSSE et al, and in further view of US Patent 5,529,648 to STICKLER.

3. Whether Claim 32, directed to a stabilized, cryogenic solid monergole propellant, should be rejected under 35 USC 103(a) as unpatentable over the combination of US Patent 3,259,532 to REYNOLDS, in view of US Patent 3,137,127 to GROSSE et al, in further view of US Patent 5,529,648 to STICKLER, and in further view of US Patent 5,834,539 to KRIVOHAVEK.

4. Whether Claim 18, directed to a method of making a cryogenic solid monergole propellant, should be rejected under 35 USC 103(a) as unpatentable over the combination of US Patent 3,259,532 to REYNOLDS, in view of US Patent 3,137,127 to GROSSE et al, in further view of US Patent 5,529,648 to STICKLER, and in further view of US Patent 5,834,539 to KRIVOHAVEK.

5. Whether Claim 42, directed to a stabilized, cryogenic solid monergole propellant, should be rejected under 35 USC 103(a) as unpatentable over the combination of US Patent 3,259,532 to REYNOLDS, in view of US Patent 3,137,127 to GROSSE et al, in further view of US Patent 5,529,648 to STICKLER, and in further view of US Patent 3,691,769 to KEILBACH et al.

(vii) THE ARGUMENTS

Claims 31, 33, 34, and 37 through 41 directed to a stabilized cryogenic solid monergole propellant, should not be rejected under 35 USC 103(a) as unpatentable over the combination of US Patent 3,259,532 to REYNOLDS, in view of US Patent 3,137,127 to GROSSE et al, and in further view of US Patent 5,529,648 to STICKLER.

Claims 31,33, 34, and 37 through 41 are directed to a novel stabilized cryogenic solid monergole propellant, that is

neither disclosed in any of the cited references nor suggested in any of the cited references, taken alone or in combination. By a monergole, Appellants mean a non-self-igniting single-component propellant, which comprises a solid or heterogeneous quasi-monergolic fuel-oxidizer combination. The fuel is an open pore plastic foam fuel, and Appellants enclose completely within the open pores of the plastic foam fuel, an oxidizer in the form of a cryogenic solid. No such structure, where a plastic foam fuel completely encompasses an oxidizer in the form of a cryogenic solid, is either disclosed or suggested in the references taken individually or in combination.

REYNOLDS relates to a combustion system comprised of a solid metallic sponge of a combustible metal such as aluminum and magnesium, with the sponge having in its interior a great number of interconnected cells, and which contains liquid oxygen in the interconnected cells. REYNOLDS proceeds on the basis of an explosive mixture that must be brought to detonation with an electrical spark (see column 2, line 46). Consequently, the object of the invention (see column 1, lines 44 to 49) is to provide a new combustion system that combines the advantages of a combustible metal with the advantages of liquid oxygen into an explosive agent, propellant or an explosive composition.

REYNOLDS solves this problem with a rigid metallic sponge, not a foam, dipped into liquid oxygen mixed in finely divided carbon, dispersed in the liquid oxygen, to saturate the

cells up to a quantity of approximately 20 to 30 percent by weight of the weight of the sponge. This explosive mixture is used as an explosive agent, combustible matter or explosive composition.

Appellants' claimed invention differs in that the combustible material and the oxidation agent are both present together in a solid phase that is stable at below normal temperatures, and not as with REYNOLDS which includes both solid and liquid phases: solid (metallic sponge and carbon) and liquid (oxidation agent). The combustible material/oxidation agent system in Appellants' invention is a monopropellant, i.e., it does not require continuous spark and deflagrates in a controlled fashion). Also, it does not lead to a detonation. With REYNOLDS, the system is explosive, i.e., there is an uncontrolled combustion that, in the case of rocket propulsion, would lead to the destruction of the rocket and therefore must be avoided at any cost. Explosive agents such as those disclosed in REYNOLDS and monergole rocket fuels according to the invention are therefore not randomly interchangeable to a person skilled in the art. See the two Wikipedia excerpts, listed in the Evidence Appendix, and directed respectively to Rocket Propellants and Explosive Materials.

In addition to this difference, there is another difference in that the material forming the sponge in REYNOLDS is different from the open-pored synthetic foam in accordance with the invention. Metallic sponges, such as described in REYNOLDS, and synthetic foams are different types of materials and therefore also

have different physical and chemical properties as well as different material characteristic values, which appear in particular in the low temperature range under load, as are inevitably encountered in rocket propulsions, and do not render it obvious to exchange one type of material for the other.

The properties of the liquid oxidation agent in REYNOLDS, which is dispersed and mixed with carbon, and the solid oxidation agent in the invention are also basically different. It is a generally known fact that all oxidation agents that are liquid below room temperature increase in density and decrease in volume when they solidify (see ROMP, Chemical Dictionary, page 4000, Volume 5; page 5011, Volume 6; page 5005, Volume 6. Georg Thieme Publishing, Stuttgart [Germany], New York, 1992). Thus, a person skilled in the art must expect significant problems as a result of the decrease in volume if he wants to apply solid/liquid systems in the low temperature range. He must expect that the systems will lose their homogeneity and that the deflagration properties will deteriorate. Because of these facts, a person skilled in the art will not readily replace the solid/liquid system of REYNOLDS with a cryogenic solid/solid system according to the presently claimed invention.

Finally, the problem to be solved by the presently claimed invention is also a different one from that in REYNOLDS, i.e., Appellants' stabilized cryogenic solid monergole propellants increase the performance of the cryogenic solid fuels compared to

the conventional solid propellants, hybrid propellants or liquid propellant systems, and improve their storage life and economic efficiency while avoiding a costly liquid management with simultaneous omission of the permanent spark in a simple manner.

REYNOLDS does not offer a person skilled in the art any suggestion to exchange the metallic sponge for an open-pored synthetic foam, and to exchange the liquid oxidation agent for a solid oxidation agent, with the open-pored foam also being present in a cryogenic solid condition.

The cited propellant body in accordance with GROSSE et al describes the preparation of a propellant by freezing, grinding, pressing or casting the elements (see column 5, lines 57 to 63). The propellant body is comprised of a liquid component and an oxidation agent, which does not combust even under atmospheric conditions. It is therefore a composite grain of a great number of frozen combustion bodies and frozen oxidation bodies that form a modular propellant body (see column 5, line 5) in the form of a body designed to burn from the inside (see Fig. 1 and 2) or in the form of an end burner (column 5, line 45, Fig. 3 to 4) designed to burn from the surface.

The combustion elements are chemically isolated from one another at the boundary surfaces by suitable cover elements (see column 6, lines 17 to 28). The combustion of modular, non-monopropellant propellant elements is principally a diffuse boundary layer combustion and as such dependent on the inflow of

reactants. If inflow does not occur via a vigorous flow, but rather only through convection, the reaction, if it occurs at all, is irregular and dragging. With propellant bodies that burn from the inside as those proposed by GROSSE et al, this is always the case for the upper (nozzle-rejecting) element; as well as in the case of the GROSSE et al propellants that burn from the outside, having a certain minimum cross-sectional surface of the elements. Therefore, it follows for a person skilled in the art that the cryogenic modular propellant bodies of single particles according to GROSSE et al cannot combust without a continuous spark.

This is also the reason why the prior art, including GROSSE et al, which has been known since June 16, 1964, was not utilized. A person skilled in the art therefore would not consider and take into account, in the solution of his problem, an inoperative solution such as the solution by GROSSE et al. However, even if a person skilled in the art would consider GROSSE et al, nevertheless, there are very significant differences between the GROSSE et al invention and the presently claimed invention.

According to GROSSE et al the combustible material and the oxidation agent are present as cryogenic particles in regular arrangement in the form of disks or layers arranged in a stacked fashion, which are generated by pressing, grinding or casting. In the presently claimed invention, the combustible material is present in the form of an open-pored foam structure of synthetic material; the liquid oxidation agent is stored in the pores of said

foam structure, and the entire structure is then frozen. The pressing, grinding or casting required in GROSSE et al is completely obsolete. This is because the liquid oxidation agent is introduced into the pore structure and transferred into a cryogenic phase that is stable below normal temperature by freezing. This creates an irregular oxidation agent structure stored in the open-pored foam structure according to the structure of the pores. The combustible material and oxidation agent are not separated by protective layers, as is the case in GROSSE et al.

Thus, one cannot simply draw from GROSSE et al, the cryogenic technique and apply it to REYNOLDS to arrive at the presently claimed invention, but rather, one must completely abandon the GROSSE et al approach to a solution, i.e., a person skilled in the art must replace the regular particle arrangement of combustible and oxidation agent grains, as taught by GROSSE et al, with the irregular arrangement of the oxidation agent in the pores of the combustible material according to the presently claimed invention.

GROSSE et al and REYNOLDS do not offer any hint that would suggest that a person skilled in the art might choose the Appellants' approach to arrive at the presently claimed invention, in particular, because a person skilled in the art must overcome a number of technical difficulties to arrive at the invention if he wants to apply the cryogenic temperatures to synthetic sponges.

These technical difficulties include the following:

frozen synthetic materials are brittle and have mechanical properties that make them appear unsuitable for the requirements in rocket propulsion systems such as stability against acceleration forces, resistance and vibrations,

there is a decrease in the volume of the liquid oxidation agents in their transfer into the frozen phase which may result in the loss of homogeneity and the combustion properties, which cannot be neglected, and

thermodynamic phase conversions in the freezing of liquid oxidation agents may cause unexpected changes in the properties of the oxidation agent.

The combustion of the cryogenic particles of GROSSE et al requires a continuous spark; in the presently claimed monergole propellants, the propellant charge is simply ignited with an igniter, that is sparked only once (see page 10, line 1 to 4 of the description) and the combustion occurs as a boundary layer combustion.

A person skilled in the art will not find any suggestion whatsoever in GROSSE et al to provide the combustible material or the oxidation agent as a structure for the other partner (oxidation agent and/or combustible matter), that is where the oxidation agent is frozen within the irregular pores of the open pore plastic foam fuel according to the present invention.

STICKLER describes a heterogeneous combustible material that comprises at least one combustible component defined as an essentially oxidation agent-free continuous solid polymeric matrix in which at least individual components of a certain size are dispersed.

This combustible component is not an open-pored foam structure with interconnected cells, but a compact solid, as is shown in particular in the following language in col. 3, lines 46 to 59 of STICKLER.

The combustible material composition comprises a mixture of a continuous combustible material phase that forms a solid matrix in which a dispersed combustible material phase is distributed. Appellants emphasize that "matrix" always means a rigid cladding material that completely encloses a different type of material. The presently claimed invention does not include a matrix in which any other material is distributed there through as a dispersion. With STICKLER, the matrix is supposed to be free of oxidation agent. In the presently claimed invention, on the other hand, the foam structure must be filled with the oxidation agent. In STICKLER, the oxidation agent and the combustible matter combust separately, whereas in the invention, they combust together

The Examiner refers to column 4, lines 50 to 58 of STICKLER which indicates that the combustible materials disclosed in the reference are substantially the same as the combustible materials disclosed in the presently claimed invention. The

STICKLER continuous phase 30 is preferably comprised of a combustible polymeric material of polymethylmethacrylate, polybutylmethacrylate, polystyrol, polybutadiene, HTPB, polyethylene, polypropylene, polyurethane, etc.

All of these combustible materials disclosed in STICKLER are present in compositions of solids and, as Fig. 3 shows, do not have an open-pored structure. Rather, it is pointed out to a person skilled in the art in column 7, lines 61 to 64 that the incorporation of bubbles (i.e., closed pores) in the synthetic material leads to a reduction of the combustible matter density and combustion speed. This statement not only establishes that STICKER does not disclose an open-pored sponge structure, but furthermore STICKLER teaches away from the presently claimed invention with its open pore plastic foam fuel having irregular pores, in which an oxidation agent is frozen in situ. See also claim 1, line 3 of STICKLER which states that the heterogeneous solid fuel material matrix is substantially free of oxidizer.

STICKLER discloses a solid/liquid system that uses a matrix of synthetic material as the combustible material, with additives dispersed therein and liquid oxygen as the oxidation agent. The fuel matrix in STICKLER is free of oxidation agent. As STICKLER shows in Fig. 2 in conjunction with column 1, lines 61 to col. 2, line 7, liquid oxygen is used as oxidation agent, which is combusted in the oxidation agent source 20 completely separately of the combustible material (see column 1, lines 61 to 63

disclosing the injection of the oxidation agent into the combustion chamber containing the combustible material).

Quite apart from STICKLER, according to the presently claimed monergole propellants, the combustible material and the oxidation agent form a complete system, which is present as a cryogenic solid/solid system. See claim 17, step (c), and claim 31, lines 8 to 14 of the present invention. STICKLER, on the other hand, leads a person skilled in the art away from a combination of REYNOLDS and GROSSE et al because, once again, STICKLER specifically points out to a person skilled in the art in column 7, lines 61 to 64 that bubble (porous) synthetic material as combustible matter has disadvantageous effects with respect to the combustible properties; yet Appellants obtain their stabilized cryogenic solid monergole propellants by forming open pores in the plastic foam fuel and filling those pores with the oxidation agent, which STICKLER indicates one should avoid.

Furthermore, STICKLER offers a person skilled in the art no suggestion whatsoever to use cryogenic temperatures in preparing rocket propellants. The Examiner is of the opinion that a person skilled in the art would arrive at the presently claimed invention by combining REYNOLDS, GROSSE et al and STICKLER in, and that this combination is obvious. Aside from the fact that the Examiner has applied a total of five prior art references, from five widely divergent fields, to support his argument that the presently claimed invention is obvious, in fact an analysis of these five

references would indicate that the presently claimed invention would not have been obvious to those "skilled in the art." The Examiner's approach to analyze the prior art references does not take into account that the problems defined in REYNOLDS, GROSSE et al and STICKLER are different from those relative to the presently claimed invention, and that REYNOLDS, GROSSE et al and STICKLER include different objects, i.e., with REYNOLDS and STICKLER obtaining a solid/liquid system and with GROSSE et al obtaining a solid/solid system in a regular, layered, modular particle arrangement, structurally very different from Appellants' solid fuel porous sponge containing the cryogenically frozen oxidizer. None of the citations, taken individually, or in combination offers a person skilled in the art any suggestion to provide the presently claimed open pore plastic foam structure as the combustible matter, with an oxidation agent frozen in situ within the pores.

On the one hand, STICKLER includes no examples for synthetic materials such as PUR, polyethylene, GAP and HTBP foam in the low temperature range in the use under the extreme loads of a rocket engine, and on the other hand, even the combustion properties of a synthetic structure with a frozen oxidation agent stored therein are not readily predictable, in particular because STICKLER clearly points out that bubbles (pores) in the synthetic material lead to a deterioration of the combustion properties and clearly states in the claims that the heterogeneous solid fuel

material is a matrix substantially free of oxidizer.

A person skilled in the art cannot take individual characteristics from each of several prior art references, cited in combination, without taking into account their means-effect correlation and without making significant changes to the present solutions that represent the state of the art. For example, one would have to apply the cryogenic engineering from GROSSE et al to the "open-pored synthetic foams" combustible materials without having any knowledge of the behavior of the synthetic foams and oxidation agents in the cryogenic temperature range and under the conditions of use with a rocket engine. Rather, what a person skilled in the art must expect from the present requirements such as elasticity against vibration or jolts by acceleration forces, and the teaching away by STICKLER (column 7, lines 61 to 64) would be that the synthetic materials are not suitable as combustible matter in the low temperature range.

Furthermore, the combination of REYNOLDS, GROSSE et al and STICKLER, which proceeds from a retrospective look with knowledge of the invention, does not take into account that the solutions by REYNOLDS and GROSSE et al date back to 1964 to 1965. If such a combination were obvious, as the Examiner would like to believe, then said combination would have to have become apparent during that extremely long period in a technical area as busy as that of rocket technology. This, however, has not happened.

Thus the overall difference between the presently claimed

monergole propellants with respect to STICKLER fuel compositions is that the main combustible material (continuous phase) in STICKLER is completely free of oxidation agent and has additives that are also combustible materials (dispersed phase). Thus, any comparison of the STICKLER combustible material to the sponge by REYNOLDS is already false and not technically tenable for that reason. STICKLER discloses an incorporation of an ancillary combustible material in the main combustible material and not, as is the case of REYNOLDS, an oxidation agent in a metal sponge. The matrix in STICKLER is a continuum, i.e., it forms a connected, compact, solid body in which the additives are distributed throughout as a dispersion. The STICKLER combustible material does not have the structure of a metallic sponge.

Again, bubbles in the matrix are a disadvantage for the combustion properties of the combustible material, as STICKLER discloses in column 7, lines 61 to 64. If bubbles are generated, they are generated in STICKLER (see column 8, 5 to 31) by encapsulation of liquids or by the storage of unmixable liquids (see column 8, 5 to 14). Liquid additives are furthermore hardened (see column 8, line 22) so that the entire body of the combustible material (matrix) is a continuum.

In any case, the STICKLER combustible material is a body that largely has no pores. This, however, is something completely different when compared to the combustible materials disclosed in either REYNOLDS or in the presently claimed invention.

In STICKLER, column 4, lines 50 to 60, a number of synthetic materials are listed which are used as a combustible material continuum. Polymethylmethacrylates and polybutylmethacrylates are glass-like thermoplastic synthetic materials (such as acrylic glass, for example). Polybutadiene is synthetic rubber. However, both synthetic materials are also not found as foam. Appellants do not claim polystyrol in claims 23 and 37. Here, HTBP, polyethylene, polypropylene and polyurethane are not present as a foam structure, but rather as a firm matrix of a self-contained body.

The Examiner's argument, i.e., that a synthetic foam may be an advantage relative to the metallic sponge in REYNOLDS because of more entropy, negates the fact that the metallic sponge and synthetic foams represent different materials, that in particular the synthetics are much more brittle in the low temperature range, and that their suitability as combustible material for a rocket engine follows from their elasticity relative to vibration and jolt sensitivity in acceleration thrust. It is absolutely clear to every person skilled in the art that synthetics are brittle in the low temperature range and that, unlike the Examiner's view, it is not only the economic advantage that must be taken into account. Furthermore, STICKLER points out the problems with the porous combustible matter (again see STICKLER, column 7, line 61 to 67). The combustible material matrix in STICKLER is not sponge-like. It is a continuum, i.e. a continuous compact phase without

interconnected pores. Fig. 3 in STICKLER represents the matrix 30, which encloses the additives 32. There are no pores there, and not even any open pores. The matrix 30 encloses the additives completely. Appellants would again like to refer to column 7, lines 61 to 64 in STICKLER.

Furthermore, it must be emphasized again that the combustible matter (matrix) in STICKLER does not include an oxidation agent. In STICKLER, the oxidation agent is spatially separated when it combusts (see Fig. 2) and the combustion gases spark the combustible material.

The Examiner's interpretation of the STICKLER reference, and its combination with REYNOLDS and GROSSE et al significantly differs from that of the Appellants. The Examiner believes that the STICKLER reference discloses a continuous, solid phase fuel matrix made of the same organic polymers that comprise the Applicants' open pore plastic foam fuel. The Examiner refers specifically to col. 4, lines 50 to 60 of STICKLER. The Examiner equates the STICKLER continuous solid phase fuel matrix with the aluminum sponge with interconnecting pores disclosed in REYNOLDS, and argues that one skilled in the art would substitute the STICKLER plastic matrix for the aluminum foam of REYNOLDS to arrive at the presently claimed invention after taking the teachings of GROSSE et al into account where both the fuel and the oxidizer are both frozen. The Examiner goes on to list what he regards as obvious advantages to using a plastic foam fuel over the aluminum

foam fuel of REYNOLDS, including the fact that plastic is lighter than metal, plastic polymers of high molecular weight would introduce more entropy into the system, and the increased molecular randomness would be of benefit in a rocket fuel, and in the art of energetic materials, it is well known that both metals and organic polymers (plastics) may serve as fuels.

Appellants do not agree that the STICKLER continuous solid phase fuel is the equivalent of the REYNOLDS aluminum sponge open pore foam and do not agree that the STICKLER continuous solid phase fuel is the same as Appellants' open pore plastic foam fuel. Applicants have looked at Fig. 3 of STICKLER and do not agree that element 30 is the same as Appellant's open pore plastic foam fuel and do not agree that element 30 in STICKLER shows an open pore foam at all. In addition the polymeric fuel disclosed in STICKLER contains two parts: one part is element 30 which is the continuous solid phase fuel and the other part is element 32 which is dispersed in element 30. STICKLER describes element 32 as a dispersed particulate phase permanently distributed in the continuous solid phase fuel. No such particulate fuel phase comprises a part of the Appellant's fuel. Therefore the STICKLER polymeric fuel is not the equivalent of either Appellant's open pore plastic foam fuel or the REYNOLDS aluminum sponge open pore foam fuel.

The STICKLER polymeric fuel features a continuous phase and a particulate phase dispersed within the continuous phase

comprising an "energetic organic compound", such as dinitrotoluene, that may include up to 20% oxygen, on a molar basis, in the dispersed phase. See col. 5 at the bottom and claim 33. Thus STICKLER does disclose an organic polymer matrix that may contain a portion of an oxidizer needed to combust the fuel. However, the reference makes no mention of cryogenic temperatures and no mention of adding the oxidizing agent to the open pore plastic foam fuel and then freezing the oxidizing agent in the pores of the foam fuel to obtain the presently claimed composition. Thus the structure of the presently claimed monergole propellants is both novel and unobvious with respect to the teachings of STICKLER and not suggested in the combination of REYNOLDS, GROSSE et al and STICKLER.

REYNOLDS includes no disclosure of an open pore plastic foam fuel and no disclosure of freezing an oxidizing agent within the pores of the foam fuel. REYNOLDS discloses an open pore aluminum sponge as the fuel which contains a liquid oxidizer, not a solid. GROSSE et al discloses adjacent layers of solid fuel and solid oxidizer. See for instance elements 12 and 13 in Fig. 1. STICKLER has no disclosure of cryogenic treatment at all for either the polymeric fuel or the oxidizer. Thus steps (a) and (b) of process claim 17 provide an additional argument for patentability over these three references in combination, over and above the fact that the cryogenic solid monergole propellant prepared according to claim 17 and the claims dependent thereon and covered by

composition claim 31 and the claims dependent thereon, differs from the compositions disclosed in all three references, and that the combination of all three of these references would not lead one "skilled in the art" to the presently claimed invention.

Appellants emphasize that the REYNOLDS compositions are explosive and that the GROSSE et al compositions are at least self-igniting, if not explosive, and that neither reference discloses a monergole. In the case of STICKLER, the reference discloses at the bottom of col. 2, that the hybrid rocket fuel according to the invention is easily prepared, cast and stored without inherent explosion hazard. However, that still does not mean that STICKLER discloses a monergole. And once again the bulk of the oxidizing agent in STICKLER is located separate from the fuel, with only a minor amount of oxidation agent located in close contact with the fuel, so the fact that Appellants are able to prepare a non self-igniting, single component fuel, a monergole with the cryogenically frozen solid oxidizer within the pores of the plastic fuel sponge, is not at all suggested by any disclosure in STICKLER that the fuel composition disclosed therein may be stored without explosion hazard. And once again, the STICKLER solid/solid system is not present as a cryogenic system. Thus the combination of REYNOLDS, GROSSE et al and STICKLER provides no basis to reject any of claims 31, 33, 34, and 37 through 41 as obvious under 35 USC 103(a).

Claims 17, 19, 22 through 30, directed to a method of making a cryogenic solid monergole propellant, should not be rejected under 35 USC 103(a) as unpatentable over the combination of US Patent 3,259,532 to REYNOLDS, in view of US Patent 3,137,127 to GROSSE et al, and in further view of US Patent 5,529,648 to STICKLER.

Appellants believe that the process to prepare the novel and structurally unobvious monergole propellants as discussed above is patentable on its own as a distinct process that is neither disclosed nor suggested in the combination of the cited prior art references. None of REYNOLDS, GROSSE et al or STICKLER, taken individually or in combination discloses or suggests either Appellants' incorporation of a liquid or gaseous oxidizer in the pores of a plastic fuel sponge, and none of the references suggests transforming the liquid or gaseous oxidizer incorporated in the solid phase plastic fuel sponge by freezing in the pores of the solid phase fuel sponge, the liquid or gaseous phase oxidizer, to obtain a stable cryogenic solid phase.

The STICKLER solid/solid system is not present as a cryogenic system. No cryogenic oxidation agent is introduced into an open pore structure of the combustible material, and it is also not frozen into the whole. Thus the process steps a) and b) in claim 17, and in the claims dependent upon claim 17, are new, and they are not obvious relative to the combination of REYNOLDS, GROSSE et al and STICKLER. These process steps in Claim 17 are

neither found nor suggested in any of the three cited references, taken individually or in combination, and furthermore it would not even be obvious to one skilled in the art, having all three references before him,

1. REYNOLDS discloses a solid/liquid system prepared at a normal temperature range, not at a cryogenic temperature.
2. GROSSE et al discloses a frozen, self-sparking solid/solid system in an evenly modular arrangement of combustible material and oxidation agent, which are separated by separating layers, with combustible material and oxidation agent being made by pressing, grinding and casting.
3. STICKLER discloses a solid/liquid system prepared at a normal temperature range without a sponge-like structure, where the oxidation agent and combustible material are combusted in separate locations, with a specific disclosure indicating that pores/bubbles in the combustible material leading to a deterioration of the combustion properties of the combustible material.

STICKLER discloses a hybrid propellant having a solid/liquid system. A system is always monopropellant if the propellant charge functions as an oxidation agent as well as a combustible material. This question does not come up in STICKLER because the bulk of the oxidation agent is spatially separated from the combustible material and is combusted (see Fig. 2 in STICKLER). Only the combustion waste gases lead to the combustion of the

combustible material in STICKLER, i.e. a continuous feed of the combustion waste gases is required.

The arrangement of combustible material disks and oxidation agent disks as self-sparking in GROSSE et al follows from GROSSE et al as such. Column 6, lines 12 to 36 tell a person skilled in the art that the individual fuel and oxidizer elements are present as alternating agents and may in addition be separated from one another by protective layers. The function of these protective layers is to prevent a quick and spontaneous reaction between the adjacent elements (see column 6, lines 23 and 24). Thus no rejection of claims 17, 19, 22 through 30 should be maintained under 35 USC 103(a) as obvious in view of REYNOLDS, GROSSE et al and STICKLER.

Claim 32, directed to a stabilized, cryogenic solid monergole propellant, should not be rejected under 35 USC 103(a) as unpatentable over the combination of US Patent 3,259,532 to REYNOLDS, in view of US Patent 3,137,127 to GROSSE et al, in further view of US Patent 5,529,648 to STICKLER, and in further view of US Patent 5,834,539 to KRIVOHAVEK.

KRIVOHAVEK is not relevant to the solution of the problem of the invention according to the Appellants, in other words, the reference is nonanalogous art, and one skilled in the art would not combine this reference with REYNOLDS, GROSSE et al and STICKLER. In any case there is no suggestion in this reference

to obtain a monergole propellant having a cryogenically frozen oxidizer within the open pores of a plastic fuel sponge according to claims 31 through 34, and 37 through 42.

KRIVOHLAVEK refers to a multi-phase emulsion, which can not be used as a rocket propellant. Since the composition is a liquid or a gel (see col. 2, lines 33 to 46), its application as a rocket propellant must be entirely excluded. Feeding the liquid multi-phase emulsion into the combustion chamber by pumps would lead to its degradation. Thus one "skilled in the art" would not use the KRIVOHLAVEK composition as a rocket fuel. Thus why would one "skilled in the art" combine the KRIVOHLAVEK composition, a composition not suitable as a rocket fuel, with the GROSSE et al composition to arrive at the present invention, especially since GROSSE et al discloses hypergolic solid propellants and not cryogenic solid monergoles? Just because KRIVOHLAVEK refers to explosives in terms of emulsions, does not mean that emulsions of cryogenic monergoles can be considered as rocket propellants at all. In any case, the GROSSE et al process requires that the hypergolic oxidizer remain separated from the fuel through the use of inhibiting layers. Therefore the combination of KRIVOHLAVEK together with GROSSE et al, or GROSSE et al, REYNOLDS, and STICKLER still would not lead one "skilled in the art" to the monergole propellant of claim 32 or to any of the other claims directed to monergole propellants.

Thus one skilled in the art would not take KRIVOHlavek into consideration and use a multi-phase emulsion as a liquid oxidizer to be cryogenically frozen to form the monergole propellant of claim 32 because

1. the multi-phase emulsion contains water;
2. the use of such an emulsion in rocket propulsion would result in de-mixing when fed into the combustion chamber; and
3. low-temperature use is not disclosed.

Claim 18, directed to a method of making a cryogenic solid monergole propellant, should not be rejected under 35 USC 103(a) as unpatentable over the combination of US Patent 3,259,532 to REYNOLDS, in view of US Patent 3,137,127 to GROSSE et al, in further view of US Patent 5,529,648 to STICKLER, and in further view of US Patent 5,834,539 to KRIVOHlavek.

KRIVOHlavek is not relevant to the solution of the problem of the invention according to the Appellants, for all of the same reasons as expressed in the preceding section discussing the rejection of claim 32. Specifically there is no suggestion in the reference to prepare a monergole propellant by incorporating other words, the reference is nonanalogous art, and one skilled in the art would not combine this reference with REYNOLDS, GROSSE et al and STICKLER. In any case there is no suggestion in this reference to prepare a monergole propellant having a cryogenically

frozen oxidizer within the open pores of a plastic fuel sponge by incorporating a liquid or gaseous oxidizer in the pores of a plastic fuel sponge, and none of the references suggests transforming the liquid or gaseous oxidizer incorporated in the solid phase plastic fuel sponge by freezing in the pores of the solid phase fuel sponge, the liquid or gaseous phase oxidizer, to obtain a stable cryogenic solid phase according to any of claims 17 through 19 and 22 through 30.

Claim 42, directed to a stabilized, cryogenic solid monergole propellant, should not be rejected under 35 USC 103(a) as unpatentable over the combination of US Patent 3,259,532 to REYNOLDS, in view of US Patent 3,137,127 to GROSSE et al, in further view of US Patent 5,529,648 to STICKLER, and in further view of US Patent 3,691,769 to KEILBACH et al.

The KEILBACH propellants are liquid slurries, such as liquid oxidizer metals, liquid oxygen, and liquid hydrogen. No cryogenic components are disclosed in KEILBACH et al. This reference deals exclusively with liquid propellants and neither discloses nor suggests any information that would enable those "skilled in the art" to deal with cryogenic solid propellants. Thus no combination of the REYNOLDS, GROSSE et al and STICKLER references with KEILBACH provides any basis to reject claim 42 or any other claim now presented as obvious under 35 USC 103.

KEILBACH et al relates to a self-igniting multi-component fuel (see column 4, line 23), while Appellants' relates to a non-self-igniting single-component fuel (monergole).

KEILBACH et al functions to protect the highly reactive fuel, for example, beryllium, from self-igniting. In Appellants' instantly claimed invention, no such protection is required since monergoles are not self-igniting. The encapsulation of the liquid phase in present claim 42, functions to disperse the liquid phase within the solid phase, i.e., to prevent an agglomeration of the liquid phase from occurring when it is dispersed within the solid phase.

The functions of the protective layer in KEILBACH et al and in Appellant's, presently claimed, monergole propellant of claim 42 therefore differ and are not comparable.

The combination of REYNOLDS, GROSSE et al, STICKLER and KEILBACH et al therefore cannot result in the monergole propellant of claim 42 because

1. REYNOLDS relates to explosive materials and not to monergoles;
2. GROSSE et al relates to self-igniting hypergoles and not to monergoles;
3. KEILBACH et al relates to multi-component systems and not to single-component materials (monergoles);
4. REYNOLDS discloses aluminum sponges and not plastic sponges;
5. in REYNOLDS, the fuel is present in the form of an aluminum sponge, while in the presently claimed invention it is not a

- metal sponge that is employed but instead a plastic sponge;
6. The encapsulation in KEILBACH et al functions as protection against reaction, the encapsulation in functions, conversely, to ensure dispersion in the fuel or in the oxidizer.

Thus this combination of references provides no basis for rejecting claim 42 under 35 USC 102(a).

Appellants conclude that no claim on appeal should be rejected as obvious under 35 USC 103(a).

Appellants respectfully request that the US Patent and Trademark Office Board of Appeals and Interferences reverse the Examiner's rejection of all claims. Appellants enclose authorization for the US Patent and Trademark Office to charge the cost of filing this Appeal Brief to the deposit account of the undersigned attorneys. Any deficiency in the payment of a fee may

be charged to the deposit account of the undersigned attorneys,
18-2025.

Respectfully submitted,

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Enclosures: Claims Appendix
Related Proceedings Appendix

(viii) CLAIMS APPENDIX

1 17. A method of making a cryogenic solid monergole
2 propellant out of a heterogeneous liquid-solid propellant, from
3 reactants at least one of which is a fuel and an oxidizer which
4 contains a phase that is liquid or gaseous at standard
5 temperature, which comprises the steps of:

6 (a) incorporating at least one liquid or gaseous phase
7 reactant in the form of an oxidizer in a solid phase structure,
8 open pore plastic foam fuel, having hollow spaces which are
9 connected to each other; and

10 (b) transforming the liquid or gaseous phase oxidizer
11 incorporated in the solid phase structure, open pore plastic foam
12 fuel, having hollow spaces connected to each other by freezing the
13 liquid or gaseous phase into a stable cryogenic solid phase below
14 standard temperature within the hollow spaces of the solid phase
15 structure, open pore plastic foam fuel, inside a combustion chamber
16 to obtain a rocket propellant with improved storability while
17 avoiding the need for liquid management and simultaneously
18 eliminating need for permanent ignition thereof.

1 18. The method of making a cryogenic solid monergole
2 propellant defined in claim 17 wherein the at least one liquid or
3 gaseous phase reactant is an emulsion of liquid components which
4 are not soluble in one another.

1 19. The method of making a cryogenic solid monergole
2 propellant defined in claim 17 wherein the at least one liquid or
3 gaseous phase reactant is a suspension of solid components in
4 liquid components or liquid impregnated bulk materials or packings.

1 22. The method of making a cryogenic solid monergole
2 propellant defined in claim 17 wherein the open pore plastic foam
3 fuel is a polyethylene foam, a polyurethane foam, a HTPB foam, or a
4 GAP foam.

1 23. The method of making a cryogenic solid monergole
2 propellant defined in claim 17 wherein the solid phase structure,
3 open pore plastic foam fuel, having hollow spaces is a packing
4 incorporated in a casting material and composed of polyethylene,
5 polyurethane, HTPB, or GAP.

1 24. The method of making a cryogenic solid monergole
2 propellant defined in claim 17 wherein according to step (a) the
3 liquid phase is incorporated in the solid phase structure by
4 immersion and/or impregnation thereof.

1 25. The method of making a cryogenic solid monergole
2 propellant defined in claim 17 wherein according to step (a) the
3 liquid or gas phase reactant is oxygen, a hydrocarbon, hydrogen

4 peroxide or an HEDM propellant.

1 26. The method of making a cryogenic solid monergole
2 propellant defined in claim 17 wherein according to step (b) the
3 solid monergole propellant is produced by freezing liquid oxidizer.

1 27. The method of making a cryogenic solid monergole
2 propellant defined in claim 26 wherein the liquid oxidizer is
3 oxygen, a hydrocarbon, hydrogen peroxide or an HEDM propellant.

1 28. The method of making a cryogenic solid monergole
2 propellant defined in claim 17 wherein according to step (a) the
3 liquid phase is initially encapsulated, then mixed with the solid
4 phase structure and bonded with the binder.

1 29. The method of making a cryogenic solid monergole
2 propellant defined in claim 17 wherein according to steps (a) and
3 (b) the liquid phase is encapsulated and before freezing the liquid
4 phase, the solid phase structure is mixed therewith, and both
5 phases are frozen together.

1 30. The method of making a cryogenic solid monergole
2 propellant defined in claim 17 wherein according to step (a)
3 combustion speed of the cryogenic solid monopropellant system is
4 adjusted by selecting a special hollow space size in the solid

5 phase structure.

1 31. A stabilized cryogenic solid monergole propellant for a
2 rocket motor combustion chamber equipped with an inner isolation
3 which comprises a solid or heterogeneous quasi-monergolic fuel
4 oxidizer combination cooled to below ambient temperature, wherein
5 at least one reactant for preparing said propellant is an oxidizer
6 in a liquid or gaseous phase at standard temperature, and at least
7 one reactant for preparing said propellant is in a solid phase
8 structure, open pore plastic foam fuel, having hollow spaces which
9 are connected to each other, arranged at an inner isolation of the
10 combustion chamber or completely filling the latter, the solid
11 phase structure, open pore plastic foam fuel, having hollow spaces
12 completely containing the liquid or gaseous oxidizer reactant
13 cryogenically transformed and stabilized as a cryogenic solid.

1 32. The stabilized cryogenic solid monergole propellant
2 defined in claim 31 wherein the at least one reactant for preparing
3 said monergole propellant in a liquid or gaseous phase at standard
4 temperature is an emulsion of liquid components not soluble in one
5 another.

1 33. The stabilized cryogenic solid monergole propellant
2 defined in claim 31 wherein the at least one reactant for preparing
3 said propellant in a liquid or gaseous phase at standard

4 temperature is a suspension of solid components in liquid
5 components.

1 34. The stabilized cryogenic solid monergole propellant
2 defined in claim 31 wherein the at least one reactant for preparing
3 said monergole propellant in a liquid or gaseous phase at standard
4 temperature is a liquid impregnated packing.

1 37. The stabilized cryogenic solid monergole propellant
2 defined in claim 36 wherein the open pore plastic foam fuel is a
3 polyethylene foam, a polyurethane foam, a HTBP foam, or a GAP foam.

1 38. The stabilized cryogenic solid monergole propellant
2 defined in claim 31 wherein the solid phase cryogenically
3 transformed from the liquid or gaseous phase is comprised of a
4 stable solid.

1 39. The stabilized cryogenic solid monergole propellant
2 defined in claim 38 wherein the solid phase cryogenically
3 transformed from the liquid or gaseous phase as a stable solid is
4 transformed oxygen, hydrocarbons, hydrogen peroxide, or an HEDM
5 propellant.

1 40. The stabilized cryogenic solid monergole propellant
2 defined in claim 31 wherein the solid phase structure, open pore

3 plastic foam fuel, having hollow spaces is comprised of a packing
4 of optionally shaped individual pieces whose hollow spaces are
5 connected together in which a frozen liquid oxidizer is contained
6 as a reactant.

1 41. The stabilized cryogenic solid monergole propellant
2 defined in claim 40 wherein the frozen liquid reactant is not in
3 homogeneous form but itself is a packing which is mixed into the
4 hollow space of the first packing.

1 42. The stabilized cryogenic solid monergole propellant
2 defined in claim 31 wherein the solid phase structure, open pore
3 plastic foam fuel, having hollow spaces is provided with a
4 protective coating which chemically insulates the solid phase
5 structure, open pore plastic foam fuel, from the reactant in the
6 liquid or gaseous phase.

(ix) EVIDENCE APPENDIX

Appellants enclose copies of the following references submitted during the prosecution of this application in order to show that Rocket Propellants on the one hand and Explosive Materials on the other hand are not treated interchangeably in the literature and are in fact treated as different materials.

1. http://en.wikipedia.org/wiki/Rocket_propellant
2. <http://en.wikipedia.org/wiki/Explosive>

The Examiner commented on these references in the office action mailed 24 June 2008 where on page 10, second paragraph, he pointed out that accidents can occur where rockets can explode and pointed to the tragedy of the Challenger Mission.

(x) RELATED PROCEEDINGS APPENDIX

There have been no decisions rendered by a court or by the Board of Appeals and Interferences in a related proceeding and no such proceeding has been identified in the Related Appeals and Interferences Section of the Appeal Brief.